

WHAT IS CLAIMED IS:

- 1 1. An optical communication system that compensates for polarization mode
2 dispersion (PMD), comprising;
3 an optical source that transmits two or more optical signals having different
4 optical frequency bands; and
5 a first optical compensator that receives the two or more optical signals and
6 rotates at least one polarization state of the two or more optical signals based on an error
7 condition to compensate for PMD.
- 1 2. The optical communication system of claim 1, further comprising:
2 a first birefringent optical conduit that receives the rotated optical signals and
3 disperses the rotated optical signals; and
4 an optical receiver that receives the dispersed optical signals, wherein the receiver
5 measures the error condition of at least a first dispersed optical signal of the dispersed
6 optical signals;
7 wherein the optical compensator adjusts the PMD of at least the first dispersed
8 optical signal by changing the polarization state of rotation based on the error condition to
9 compensate for PMD.
- 1 3. The optical communication system of claim 2, wherein the error condition
2 is based on a number of bit-errors of the first received signal.
- 1 4. The optical communication system of claim 2, wherein the error condition
2 is based on a failure of the first received signal.
- 1 5. The optical communication system of claim 2, wherein the error condition
2 is based on a PMD measurement of the first received signal.
- 1 6. The optical communication system of claim 2, wherein the first optical
2 compensator is a single rotation device that rotates the polarization state of each of the
3 two or more optical signals.
- 1 7. The optical communication system of claim 2, wherein the first optical
2 compensator includes at least two rotation devices that rotate the polarization state of
3 each of the two or more optical signals along at least two axes.
- 1 8. The optical communication system of claim 7, wherein the at least two
2 axes are substantially orthogonal.

1 9. The optical communication system of claim 2, wherein the first optical
2 compensator comprises:

3 an optical splitter that receives the two or more optical signals and splits the two
4 or more optical signals;

5 two or more polarization rotation devices that receive the two or more optical
6 signals and wherein at least one polarization rotation device rotates the polarizartion
7 angles of at least one optical signal; and

8 an optical combiner that receives the rotated optical signals, combines the optical
9 signals and provides the combined rotated optical signals to the single optical conduit.

1 10. The optical communication system of claim 2, wherein the first optical
2 compensator is positioned at a location between the optical source and the optical
3 receiver and defined by the ratio L_1 / L_2 ;

4 wherein L_1 / L_2 is less than approximately 1.5, and wherein L_1 is the length of a
5 first optical conduit between the optical compensator and optical source, and L_2 is the
6 length of the second optical conduit between the optical compensator and optical
7 receiver.

1 11. The optical communication system of claim 10, wherein L_1 / L_2 is
2 approximately $1.5 \geq (L_1 / L_2) \geq 0.25$.

1 12. The optical communication system of claim 11, wherein the ratio L_1 / L_2 is
2 approximately 0.65.

1 13. The optical communication system of claim 2, wherein the first optical
2 compensator is positioned at a location between the optical source and the optical
3 receiver and defined by the ratio $\overline{\Psi}_1 / \overline{\Psi}_2$;

4 wherein $\overline{\Psi}_1 / \overline{\Psi}_2$ less than approximately 1.2, and wherein $\overline{\Psi}_1$ is the average
5 PMD of a first optical conduit between the optical compensator and optical source, and
6 $\overline{\Psi}_2$ is the average PMD of the second optical conduit between the optical compensator
7 and optical receiver.

1 14. The optical communication system of claim 13, wherein is $\overline{\Psi}_1 / \overline{\Psi}_2$
2 approximately $1.2 \geq (\overline{\Psi}_1 / \overline{\Psi}_2) \geq 0.5$.

1 15. The optical communication system of claim 14, wherein the ratio $\overline{\Psi}_1 / \overline{\Psi}_2$
2 is approximately 0.8.

1 16. The optical communication system of claim 2, further comprising at least a
2 second optical compensator and a second optical conduit, wherein the second optical
3 compensator receives the two or more optical signals from the optical source, second
4 rotates the polarization state of at least one optical signal based on the error condition and
5 provides the second rotated signals to a second optical conduit, and wherein the second
6 optical conduit provides the two or more second rotated optical signals to the first optical
7 compensator.

1 17. A method for compensating for polarization mode dispersion (PMD),
2 comprising;
3 rotating the polarization states of one or more optical signals based on an error
4 condition of at least one of the optical signals at an optical compensator; and
5 dispersing the rotated optical signals using a first birefringent optical conduit to
6 compensate for PMD.

1 18. The method of claim 17, further comprising:
2 receiving the dispersed optical signals at an optical receiver;
3 measuring the error condition at the optical receiver; and
4 changing the polarization state of rotation at the optical compensator based on the
5 error condition to compensate for PMD.

1 19. The method of claim 18, wherein the error condition is based on a number
2 of bit-errors of the first received signal.

1 20. The method of claim 18, wherein the error condition is based on a failure
2 of the first received signal.

1 21. The method of claim 18, wherein the error condition is based on a PMD
2 measurement of the first received signal.

1 22. The method of claim 18, wherein the step of rotating includes rotating a
2 polarization state of one or more optical signals about a single pre-determined axis.

1 23. The method of claim 18, wherein the step of rotating includes rotating a
2 polarization state of one or more optical signals around two predetermined axes.

1 24. The method of claim 23, wherein the two predetermined axes are
2 substantially orthogonal.

1 25. The method of claim 18, wherein the step of rotating comprises:
2 splitting at least two of the optical signals;
3 rotating the polarization states of at least one of the split optical signals;
4 and
5 combining the split optical signals.

1 26. The method of claim 18, wherein the step of rotating occurs at a location
2 between the optical source and the optical receiver and defined by the ratio L_1 / L_2 ;
3 wherein L_1 / L_2 is less than approximately 1.5, and wherein L_1 is the length of a
4 first optical conduit between the optical compensator and optical source, and L_2 is the
5 length of the second optical conduit between the optical compensator and optical
6 receiver.

1 27. The method of claim 26, wherein L_1 / L_2 is approximately $1.5 \geq (L_1 / L_2) \geq$
2 0.25.

1 28. The method of claim 27, wherein the ratio L_1 / L_2 is approximately 0.65.

1 29. The method of claim 18, wherein the step of rotating occurs at a location
2 between the optical source and the optical receiver and defined by the ratio $\overline{\Psi}_1 / \overline{\Psi}_2$;
3 wherein $\overline{\Psi}_1 / \overline{\Psi}_2$ less than approximately 1.2, and wherein $\overline{\Psi}_1$ is the average
4 PMD of a first optical conduit between the optical compensator and optical source, and
5 $\overline{\Psi}_2$ is the average PMD of the second optical conduit between the optical compensator
6 and optical receiver.

1 30. The method of claim 29, wherein is $\overline{\Psi}_1 / \overline{\Psi}_2$ approximately $1.2 \geq (\overline{\Psi}_1 /$
2 $\overline{\Psi}_2) \geq 0.5$.

1 31. The method of claim 30, wherein the ratio $\overline{\Psi}_1 / \overline{\Psi}_2$ is approximately 0.8.

 32. The method of claim 18, wherein the step of rotating comprises:
 first rotating the polarization states of the two or more optical signals received
 from the optical source using a first optical compensator;
5 second propagating the two or more first rotated optical signals using a second
 optical conduit;

second rotating the polarization states of the two or more optical signals received from second optical conduit using a second optical compensator, wherein the second optical compensator provides the two or more second rotated optical signals to the first optical conduit;